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(54) **Apparatus for collecting swarf at the boring location of a boring tool**

(57) Swarf or dust generated at the boring location of a drill 2 is collected in a sleeve including a rigid portion 17 having a mouth 13 in contact with the work, a hose 18 and a ring member 16 on which a mounting ring 3, detachably fixed to a drill chuck 1, is rotatably mounted. The hose 18 and compression springs 19, incorporated therein, are compressed as the drilling proceeds. Initially the sleeve extends at least as far as the drill tip with a sealing ring 14 closing off the boring location. In a modification the hose is replaced by telescoping sleeve portions with a spring interposed between the ring member 16 and sleeve 17. In another modification the hose and springs are replaced by a helically wound spring strip with adjacent turns overlapping and in sliding contact. A handle 24 can also be used to connect a suction source to the sleeve.

FIG. 1

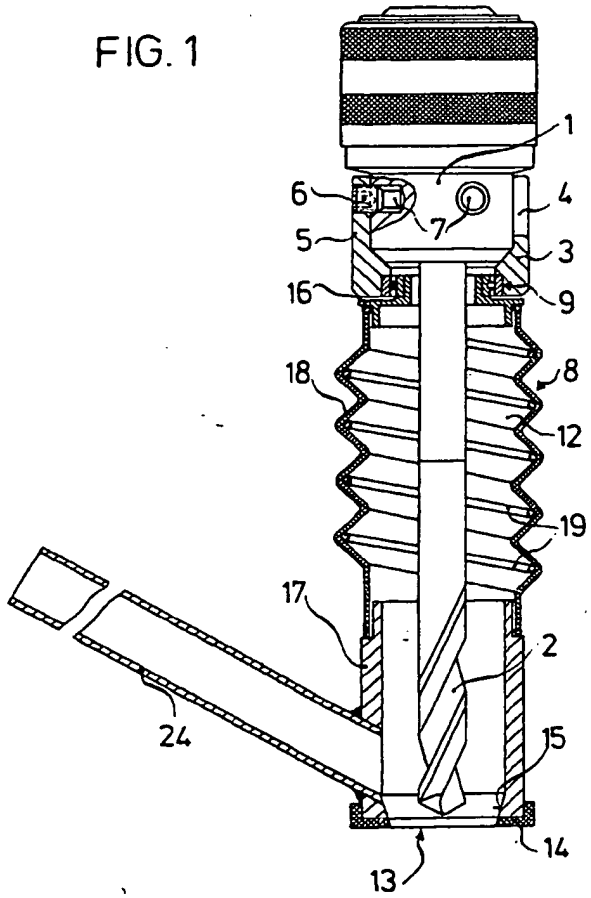

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FIG. 1

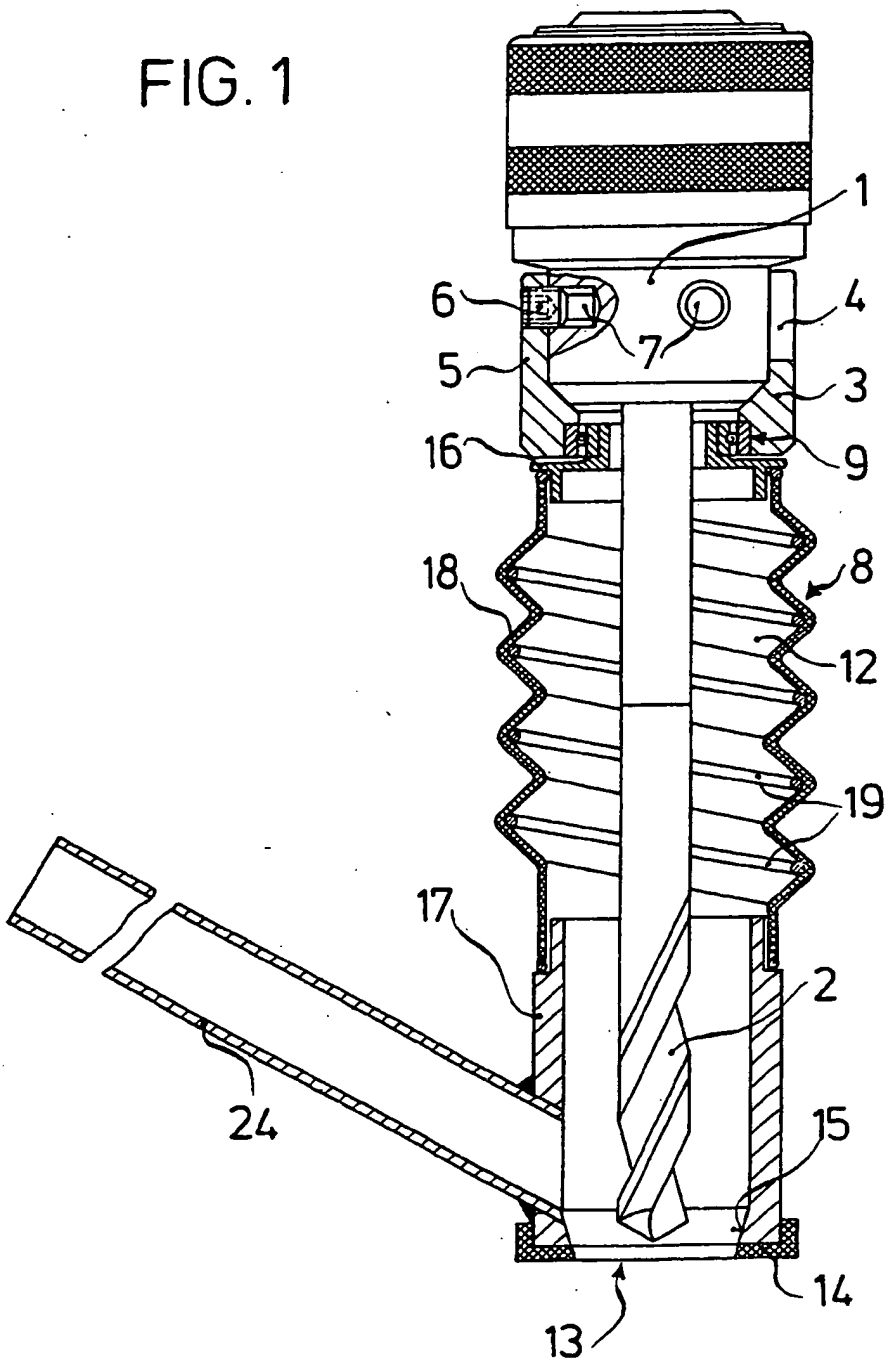


FIG. 2

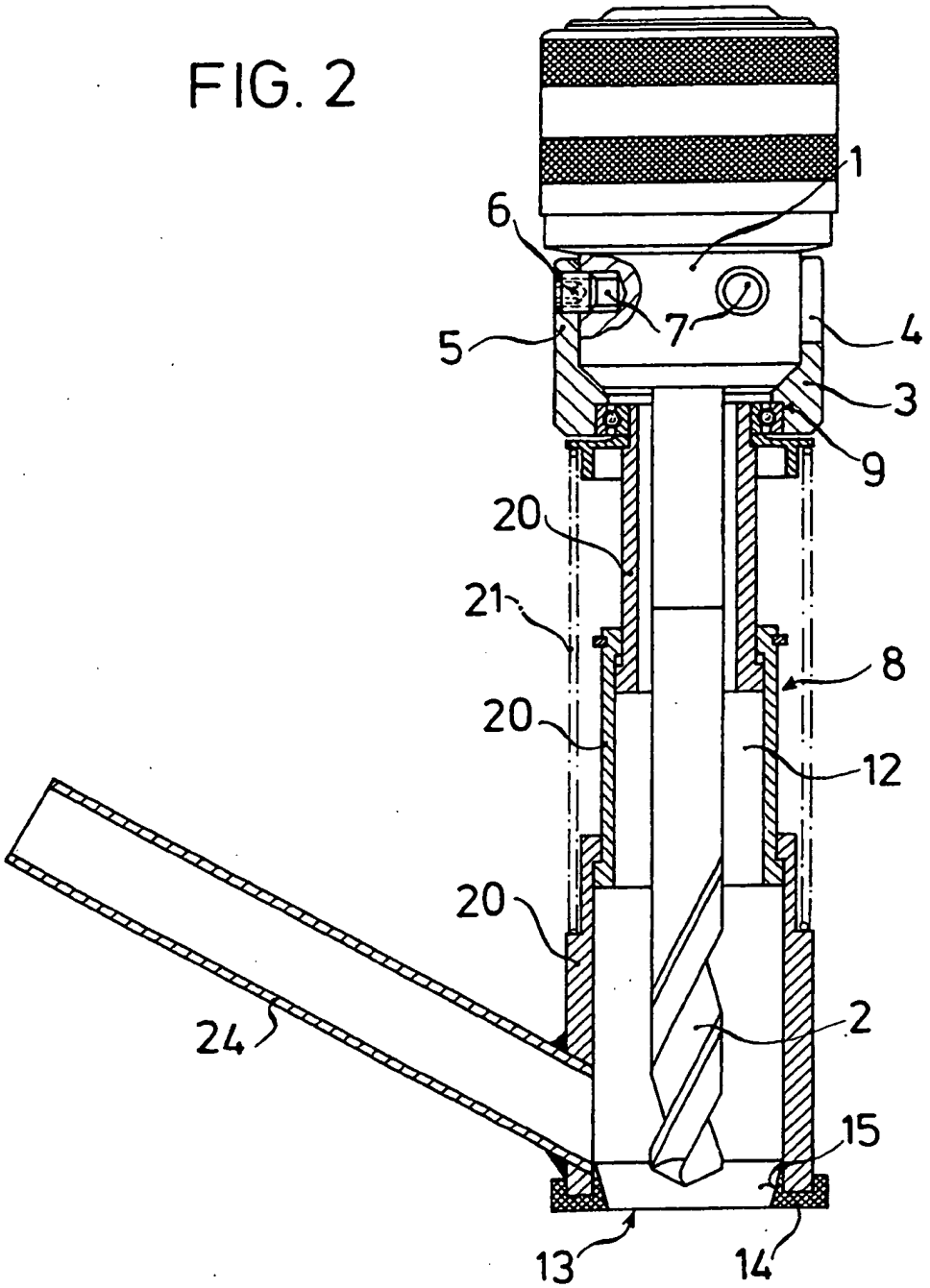
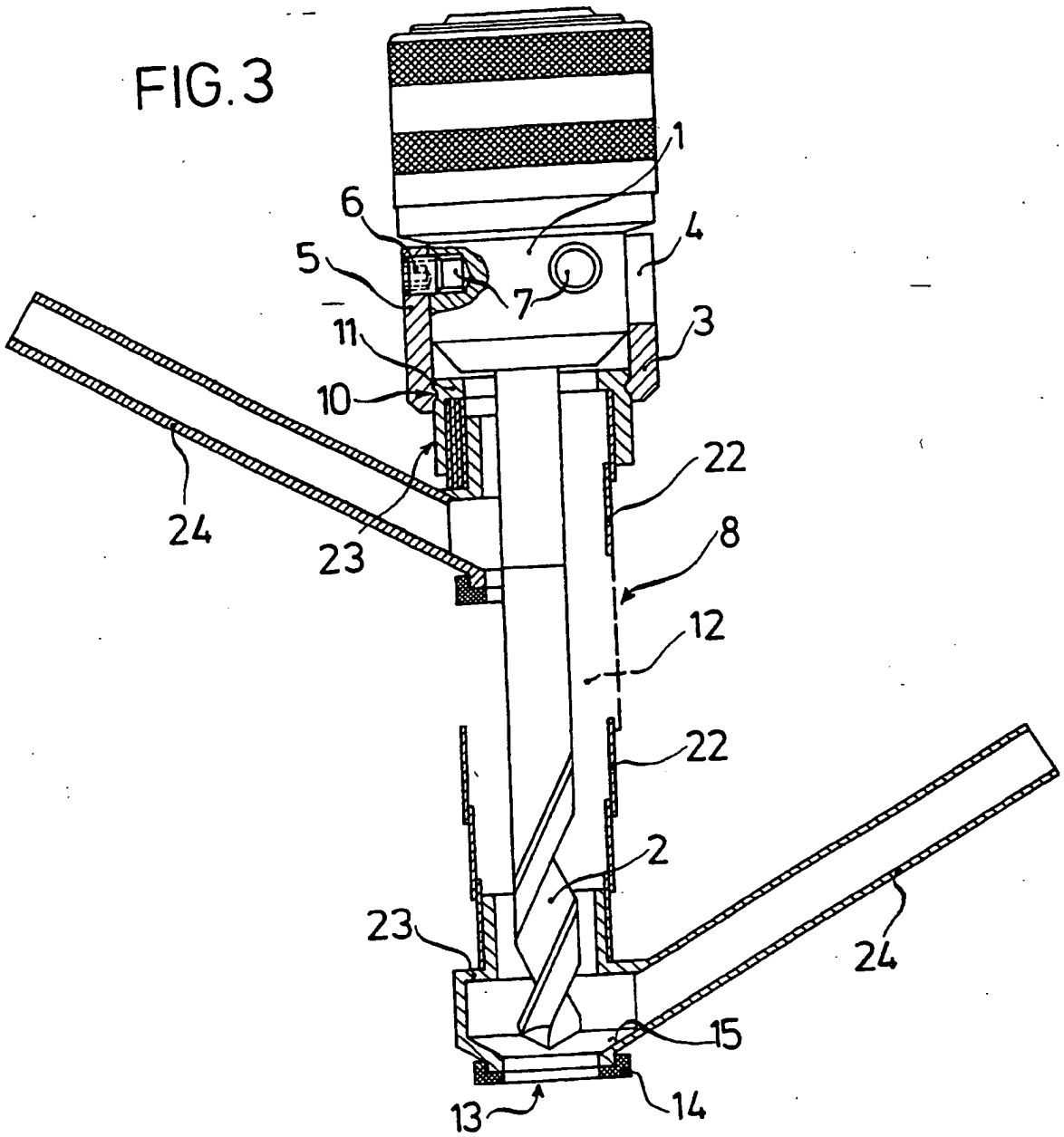


FIG.3



SPECIFICATION

Apparatus for collecting swarf at the boring location of a boring tool

The invention relates to an apparatus for collecting swarf or boring dust at the boring location of a boring tool which is gripped in the boring chuck of a boring machine.

Apparatuses are known, which provide for sucking away the swarf or boring dust which are produced when boring into work, thereby to prevent fouling which would otherwise be caused by the swarf or boring dust, of the area around the boring location. In an apparatus of this kind, which is disclosed in DOS No. 24 17 228, the swarf or boring dust is sucked away by a longitudinal duct provided in the boring tool. In other suction removal apparatuses which are known from practical use, there is a suction member through which the boring tool passes and which has a suction mouth which can be applied against the surface being bored, and a connection for a suction pipe. The suction member is mounted on rails displaceable parallel to the boring axis with the rails being guided on the housing of the boring machine. As the boring operation progresses, the suction member with the rails can be pushed back to allow the boring tool increasingly to penetrate into the hole being bored. In every case, such an apparatus permits the swarf or boring dust to be collected, only in conjunction with a suitable suction fan and a suction pipe which connects the suction fan to the suction member or to the longitudinal duct in the boring tool.

The invention is based on the problem of providing an apparatus of the above-indicated kind, which collects the swarf or boring dust produced, without requiring for that purpose a suction removal means and the connection for a suction pipe.

According to the invention, apparatus for collecting swarf or boring dust at the boring location of a boring tool which is gripped by a chuck of a boring machine, when the machine is in operation, comprises a mounting ring which, when in use, is secured to the chuck, a sleeve, spring forced towards the machine and so mounted coaxially with the boring tool as to permit the chuck to rotate relatively to the sleeve, the sleeve providing a collecting chamber for swarf and boring dust and being compressible against the spring force from an extended condition to a condition in which it is compressed as far as or behind the tip of the boring tool, and a sealing ring provided at a mouth opening at the end of the sleeve remote from the chuck, which sealing ring bears under the spring force, when the tool is in use, against the area surrounding the boring location, thereby closing off the periphery of the boring location.

At one end the sleeve is sealingly connected to the boring chuck, but does not participate in the rotary movement thereof. At the other end, the sleeve bears by means of its sealing ring against the surface being bored, under the spring force, so that, in the boring operation, the interior of the sleeve forms a collecting chamber which is sealed off both at that surface and also at the boring chuck, with the swarf or boring dust coming from the hole being bored being collected and caught in the above-mentioned collecting chamber. As the boring operation proceeds, with the hole increasing in depth, the sleeve is compressed axially, against the spring force, although as that happens the sealed closure of the sleeve in contact with the surface being bored and at the boring chuck is maintained at all times. Accordingly, there is no possibility of swarf or boring-dust which are produced during the boring operation being able to escape from the sleeve to the exterior. There is also the advantage that, when the boring tool is applied against the work to be bored, the sleeve can initially be pushed back by hand, whereby it is possible to monitor precise centering of the boring tool at the location at which boring is to be effected. When the boring tool has been properly located, the sleeve is released so that it bears sealingly against the surface, under the spring force, and the boring operation can begin. When the boring operation is concluded, the boring tool and the boring machine merely have to be removed from the boring location in such a way that the boring dust or swarf in the sleeve cannot fall out of the sleeve at the front end thereof. The deeper the boring dust or swarf have been moved rearwardly into the sleeve during the boring operation, the easier it is to prevent the swarf or boring dust from falling out of the front end of the sleeve. An embodiment of the invention, which is advantageous in this respect, is characterised in that the interior of the sleeve is increased in width directly adjoining the front mouth opening of the sleeve. The mouth opening of the sleeve is then reduced in size in comparison with the interior of the sleeve, and that makes it difficult for swarf or boring dust to escape from the sleeve. In particular, it may also be desirable for the enlargement in the size of the space within the sleeve to be of a tapered configuration, whereby the inside surface of the sleeve is tapered. Particules of boring dust which are transported out of the hole being bored by the boring tool and flung against the tapered inside surface of the sleeve by centrifugal force due to rotation of the boring tool are caused to pass axially further into the interior of the sleeve, by virtue of their impinging against the tapered inside surface of the sleeve, so that the boring dust or swarf collects at an axially deep position in the interior of the sleeve. When, after the boring operation, the boring machine with the tool is tilted downwardly in order to empty the sleeve, then the boring dust or swarf can easily fall out of the sleeve, in spite of the reduced mouth opening of the sleeve, along the tapered inside surface of the sleeve.

The sleeve itself can be embodied in various ways. Thus, apart from a mounting ring which is carried on the mounting ring secured to the chuck, the sleeve may comprise an easily deformable material and is stabilised by a spring member producing the spring force. More particularly, the sleeve may comprise a hose member which is fixedly connected at one end to a mounting ring and at the other end to the sealing ring, and the spring member may comprise

at least one helical spring which is connected to the wall of the hose member. The helical spring can be joined to the wall of the hose member, on the inside or the outside thereof. In an advantageous embodiment, the coil spring may also be embedded in the wall of the hose member. The material of the sleeve may be rubber. The sleeve may be formed as a concertina-like bellows member.

Another advantageous embodiment of the invention is characterised in that the sleeve comprises a series of sleeve portions which are guided telescopically on each other, and a coil spring producing the spring force is arranged and stressed between the two sleeve portions at the axial ends of the series. This construction has the advantage that the sleeve is inflexible transversely with respect to the boring tool axis, that is to say, in particular it can form a handle with which the boring machine can be additionally guided when setting the boring tool in place and during the boring operation. The same advantage is achieved by virtue of a sleeve structure such that the sleeve is formed by a coil spring which is would from a spring strip in such a way that each two adjacent windings of the spring partly overlap against each other and are in sliding contact with each other so as to be displaced against each other axially as the spring expands or contracts the ends of the spring each being connected to a respective rigid ring portion. The ring portions then serve on the one hand for mounting the arrangement on the mounting ring on the boring chuck and on the other hand for forming or for connecting the sealing ring.

Irrespective of its particular design configuration, the sleeve may be provided, in the region of its front end, with a laterally projecting handle portion by means of which the sleeve can be axially compressed manually and/or can be guided, if the sleeve is of the appropriate rigidity in a transverse direction. The handle portion can be formed as a tube, the interior of which communicates with the space within the sleeve, so that in principle it is possible for a suction pipe or hose to be connected to the sleeve by way of the handle portion, if for example when carrying out prolonged boring processes, it appears too time-consuming or too troublesome to empty the sleeve between the individual boring operations by tipping the boring machine downwards.

Examples of the invention will be described in greater detail hereinafter with reference to the accompanying drawings in which:

Figures 1 to *3* show views in axial section respectively of three different forms of apparatus.

The boring machine is not shown in the drawings.

In each Figure, the boring chuck is indicated in part, by reference numeral 1. A drill which is gripped in the chuck 1 is indicated by reference numeral 2. Provided on the chuck 1 is a mounting ring 3 which can be easily and rapidly secured to and removed again from the chuck 1. For that purpose, the mounting ring has a collar portion 5 which is formed as a clamp ring, by virtue of a longitudinal slot 4, and which carries at least one locking screw 6 which engages into one of a number of radial holes 7 provided in the chuck 1 for fitting the conventional chuck key. A sleeve which is generally indicated by reference numeral 8 is mounted rotatably on the mounting ring 3 and is axially loaded towards the boring machine, that is to say, upwardly in the drawing. For that purpose, the embodiments shown in Figures 1 and 2 have a ball bearing assembly 9, while the embodiment shown in Figure 3 has a simple plain bearing 10 which is formed by a ring member 11 which is fitted rotatably and axially immovably into the mounting ring 3 and which, in order to reduce sliding friction, may comprise a plastics material which is particularly suitable for that purpose. At any event, irrespective of the nature of the bearing 9, 10, the sleeve 8 is arranged coaxially with respect to the drill 2. The sleeve 8 forms a closed collecting chamber 12 for the swarf or boring dust. For that purpose, it extends forwardly beyond the chuck 1 and thus encloses the drill 2. The sleeve 8 can be compressed against a spring force in the opposite direction, that is to say, towards the boring machine, this being upwardly in the drawings, with the length of the sleeve being axially reduced. In the condition in which the length of the sleeve is not reduced, the sleeve 8 extends with its forward mouth opening 13 at least as far as the tip of the drill 2. The forward mouth opening 13 is formed as a sealing ring 14, for example in the form of a rubber ring, which is applied by the spring force against the work being bored in the area directly around the boring location, and thereby seals off the boring location in an outward direction so that boring dust or swarf coming from the hole being bored is caught in the collecting chamber 12 in the sleeve.

The space inside the sleeve 8 is increased in size radially, directly adjoining the mouth opening 13 at the front of the sleeve. In the illustrated embodiments, the enlargement in the size of the space within the sleeve is of a tapered configuration, thus forming a tapered inside surface 15 which converges towards the mouth opening 13 of the sleeve. Boring dust or swarf which is transported out of the hole being bored by the drill 2 in the spiral flutes thereof are flung by centrifugal force against the tapered inside surface 15, by the drill which rotates at high speed, whereby the boring dust has imparted thereto a component of movement which is directed axially into the interior of the sleeve and which has the result that the boring dust or swarf are transported axially deeper into the collecting chamber 12 so that the swarf no longer collects directly behind the mouth opening 13 of the sleeve and can immediately fall out of the sleeve again through the mouth opening thereof, when the boring machine and the sleeve are taken away from the surface through which the hole is being bored. In order to empty the sleeve 8, the boring machine with the drill and sleeve must be tilted downwardly.

In the embodiment shown in Figure 1, except for a mounting ring member 16 which is supported on the mounting ring 3 and a rigid sleeve portion 17 which carries the sealing ring 14, the sleeve comprises an easily deformable material, namely a hose member 18 which is formed in the manner of a concertina-like bellows member and which is stabilised by helical springs 19, there being two coil springs in the

illustrated embodiment. The coil springs 19 are connected to the peripheral portion of the hose member, on the inside thereof, and produce the spring force against which the sleeve is axially compressible. The material of the sleeve may be of a resilient rubber material. It is also possible, although this is not shown in the drawing, for the coil spring or springs to be embedded directly into the wall of the hose member.

In the embodiment shown in Figure 2, the sleeve 8 comprises sleeve portions 20 which are guided telescopically on each other. A coil spring is again arranged between the two sleeve portions which are at the axial ends of the sleeve, to produce the required spring force, and is stressed between the end components, as a compression spring.

In the embodiment shown in Figure 3, the sleeve 8 is formed directly by a coil spring 22 which produces the required spring force. The coil spring 22 is wound from a flat spring strip in such a way that respective adjacent windings or turns partially overlap each other and are slideable against each other, that is to say, they are closed off against each other and are displaceable axially against each other, as the spring moves. The ends of the spring are each connected to a respective rigid ring portion 11, 23, the ring portion 11, which is at the end towards the clamping chuck, forming the abovementioned sliding bearing 10 while the ring portion 23 at the opposite end forms the carrier for the sealing ring 14. The axially compressed condition of the sleeve 8 is shown in the left-hand half of Figure 3, at 23.

In the embodiments shown in Figures 2 and 3, in spite of the sleeve being axially adjustable in length, the sleeve 8 behaves as a virtually rigid component, transversely with respect to the drill axis, that is to say, it is inflexible in that direction, and can therefore be used as an additional handle for guiding the boring machine during the boring operation. So that the sleeve 8 can also be compressed manually, for example before the boring operation, while the drill is initially being applied to the location at which the hole is to bored and while the precise point at which the drill is applied to the surface to be bored is being checked. The sleeve 8 is also provided with a laterally projecting lower portion serving as a handle, in the region of the front end of the sleeve 8. The lower portion 24 can be formed as a tube, the interior of which communicates with the space 12 within the sleeve 8. By virtue of this arrangement, a suctionpipe or hose (not shown) can be connected to the lower handle portion 24 if, for any reason whatever, there is a wish to suck out the boring dust or swarf which have passed into the sleeve 8, during the boring operation. Desirably, the tube forming the handle portion 24 opens at least with a part of the mouth cross-section thereof, in the region of the sleeve which is already enlarged by the tapered surface 15. The ring portion 23 may be provided with an upper handle portion 24 as shown in Figure 3.

CLAIMS

1. Apparatus for collecting swarf or boring dust at the boring location of a boring tool which is gripped by a chuck of a boring machine when the machine is in operation, the apparatus comprising a mounting ring which, when in use, is secured to the chuck, a sleeve, spring forced towards the machine and so mounted coaxially with the boring tool as to permit the chuck to rotate relatively to the sleeve, the sleeve providing a collecting chamber for swarf and boring dust and being compressible against the spring force from an extended condition to a condition in which it is compressed as far as or behind the tip of the boring tool, and a sealing ring provided at a mouth opening at the end of the sleeve remote from the chuck, which sealing ring bears under the spring force, when the tool is in use, against the area surrounding the boring location, thereby closing off the periphery of the boring location.

2. Apparatus according to Claim 1, in which the space within the sleeve is enlarged directly adjoining the mouth opening of the sleeve.

3. Apparatus according to Claim 2, in which the enlargement is of a tapered configuration converging towards the suction mouth.

4. Apparatus according to one of Claims 1 to 3, in which the sleeve comprises a length of an easily deformable material stabilised by spring means which produces the spring force, and a ring member which is adjacent the mounting ring and relatively to which the mounting ring rotates during a boring operation.

5. Apparatus according to Claim 4, in which the sleeve comprises a hose member which is fixedly connected at one end to the ring member and at the other end to the sealing ring, and the spring means comprises at least one helical spring which is connected to the wall of the hose member.

6. Apparatus according to Claim 5, in which the helical spring is embedded into the wall of the hose member.

7. Apparatus according to any one of Claims 4 to 6 in which the material of the hose member is resilient.

8. Apparatus according to any one of Claims 4 to 6, in which the hose member is in the form of a concertina-like bellows member.

9. Apparatus according to any one of Claims 1 to 3, in which the sleeve comprises a series of sleeve portions which are guided telescopically on each other and a coil spring for producing the spring force is arranged and stressed between the two sleeve portions at the axial ends of the series.

10. Apparatus according to any one of Claims 1 to 3, in which the sleeve is formed by a helical spring which is wound from a spring strip in such a way that each two adjacent turns partially overlap and are in sliding contact with each other so as to be displaced axially against each other as the spring expands or contracts, the ends of the spring being connected respectively to rigid ring portions.

11. Apparatus according to any one of Claims 1 to 10, in which in the region of its end remote from the chuck the sleeve is provided with a laterally projecting portion serving as a handle.

12. Apparatus according to Claim 11, in which the handle portion is formed as a tube, the interior of which is in communication with the interior of the

sleeve.

13. Apparatus substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

14. Apparatus substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

15. Apparatus substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

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